US Army Corps
of Engineers
Portland District

EPA
Region 10

Characterization of Sediments from The Chetco River Mouth and Small Boat Basin

Final Report
May 1991

Characterization of Sediments From the Chetco River Mouth and Small Boat Basin

Prepared For:
U. S. Environmental Protection Agency
Region 10
Seattle, Washington

Prepared By:
U. S. Army Corps of Engineers
Portland District
Portland, Oregon

May 1991

Report Preparers

Jim Britton	Biologist	CENPP-PE-HR
Mark Siipola	Civil Engineer	CENPP-PE-HR
John Malek	Dredging and Ocean Dumping Coordinator	Region 10, EPA

TABLE OF CONTENTS

LIST OF TABLES

APPENDIX CONTENTS

Characterization of Sediments From the Chetco River Mouth and Small Boat Basin

Abstract

1. Sediments, from the Federal channel at the outlet of the Chetco River and from two nearby small boat basins, were analyzed for physical characteristics such as grain size, percent fines and volatile solids. They were also analyzed chemically for metals, pesticides, PCBs, PAHs, phenols and other semivolatiles. Results show that Federal project sediments near the mouth of the Chetco River are sandy/gravelly material low in fines (0.4-12.6%) and volatile solids (2-4.2%). Sediments from the small boat basins are higher in fines (67-86%), volatile solids (4.7-7.6%) and TOC (11-23 mg/g). Small boat basin sediments contained some PAHs (total 231-601 ppb) and pesticides (3-20 ppb). PCBs were found in one small boat basin sample (277 ppb). In general, metals concentrations in samples were comparative to concentrations observed in an earlier sampling trip in 1982. Sample, CHR-5, from a small boat basin showed higher concentrations in 6 of 8 metals detected.

Introduction

2. Previous chemical characterization of sediments from the Chetco River Small Boat Harbor is limited to the data from a few samples taken in 1982 by USACE. To improve our knowledge of Chetco River sediments USEPA, Region 10 and USACE, Portland District entered into agreement, with funding from USEPA, to sample Chetco River sediments for physical and chemical analysis. Sampling of Chetco River sediment was undertaken in August 1990.

Background

3. The Chetco River flows into the Pacific Ocean at a point about 300 miles south of the mouth of the Columbia River. Percy et. al. (1), in a description of Oregon's estuaries, described the river and estuary. The river drains a basin of roughly 359 square miles and the is 58 miles long. Most of the basin is within the Siskiyou National Forest. A tributary, the North Fork, is 14 miles long and drains an area of 40 square miles. The Chetco River estuary is one of the smallest on the Oregon coast, comprising about 140 acres during high water. Rainfall varies from 80 inches per year at the mouth to 120 at the headwaters. The average annual water yield at the mouth is 1,230,000 ac-ft.

4. The Chetco estuary is fluvially dominated and most of its sediment bedload is thought to be transported to the ocean (3). Some sediment is dredged from the estuary, generally from the river mouth and near the boat basins. Dredged material is placed in the offshore Ocean Dredged Material Disposal Site (ODMDS). During the ten year period 1976-85, an average of 47,792 c.y. of material was dredged annually.

5. Sediments in the Chetco estuary have been characterized as fine to medium sands with a volatile solids content ranging from 1.29 to 7.19 percent (1,2). Some chemical analyses were performed on boat basin samples in April 1982. There were no unusual elevations of metals, pesticides or PCBs (3). Sediments from the Federal dredging project in the estuary are very similar to the ODMDS sediments (3).

Characterization of Sediments From the Chetco River Mouth and Small Boat Basin

Abstract

1. Sediments, from the Federal channel at the outlet of the Chetco River and from two nearby small boat basins, were analyzed for physical characteristics such as grain size, percent fines and volatile solids. They were also analyzed chemically for metals, pesticides, PCBs, PAHs, phenols and other semivolatiles. Results show that Federal project sediments near the mouth of the Chetco River are sandy/gravelly material low in fines (0.4-12.6%) and volatile solids (2-4.2%). Sediments from the small boat basins are higher in fines (67-86%), volatile solids (4.7-7.6%) and TOC (11-23 mg/g). Small boat basin sediments contained some PAHs (total 231-601 ppb) and pesticides (3-20 ppb). PCBs were found in one small boat basin sample (277 ppb). ← In general, metals concentrations in samples were comparative to concentrations observed in an earlier sampling trip in 1982. Sample, CHR-5, from a small boat basin showed higher concentrations in 6 of 8 metals detected.

Introduction

2. Previous chemical characterization of sediments from the Chetco River Small Boat Harbor is limited to the data from a few samples taken in 1982 by USACE. To improve our knowledge of Chetco River sediments USEPA, Region 10 and USACE, Portland District entered into agreement, with funding from USEPA, to sample Chetco River sediments for physical and chemical analysis. Sampling of Chetco River sediment was undertaken in August 1990.

Background

3. The Chetco River flows into the Pacific Ocean at a point about 300 miles south of the mouth of the Columbia River. Percy et. al. (1), in a description of Oregon's estuaries, described the river and estuary. The river drains a basin of roughly 359 square miles and ~~the~~ is 58 miles long. Most of the basin is within the Siskiyou National Forest. A tributary, the North Fork, is 14 miles long and drains an area of 40 square miles. The Chetco River estuary is one of the smallest on the Oregon coast, comprising about 140 acres during high water. Rainfall varies from 80 inches per year at the mouth to 120 at the headwaters. The average annual water yield at the mouth is 1,230,000 ac-ft.

4. The Chetco estuary is fluvially dominated and most of its sediment bedload is thought to be transported to the ocean (3). Some sediment is dredged from the estuary, generally from the river mouth and near the boat basins. Dredged material is placed in the offshore Ocean Dredged Material Disposal Site (ODMDS). During the ten year period 1976-85, an average of 47,792 c.y. of material was dredged annually.

5. Sediments in the Chetco estuary have been characterized as fine to medium sands with a volatile solids content ranging from 1.29 to 7.19 percent (1,2). Some chemical analyses were performed on boat basin samples in April 1982. There were no unusual elevations of metals, pesticides or PCBs (3). Sediments from the Federal dredging project in the estuary are very similar to the ODMDS sediments (3).

6. The purpose of the present study was to provide additional information on the physical properties and possible chemical contaminants in sediments from the Chetco River boat basins. Most of the available information is based on samples from within the Federal project. In the present study samples were taken from both within and outside of the Federal project - particularly in the two small boat basins (upstream sport fishing marina and downstream commercial basin marina - see map, figure 1).

Methods

7. A total of 8 sediment samples were taken by ponar grab sampler for physical analysis. The ponar grabs a sample of about 9 cm in depth, representing the surface sediment layers. Grain size distribution and volatile solids content of each sample were measured by Portland District, Corps of Engineers Materials Lab, Troutdale, Oregon.

8. Sediment samples for chemical analysis were taken from the ponar grab using acid rinsed stainless steel spatulas and cold stored in acid cleaned I-Chem jars capped with teflon lined lids. Six of the eight samples were analyzed for the following chemical constituents: total organic carbon (TOC), metals, tributyltin (TBT), polyaromatic hydrocarbons (PAHs), polychlorobiphenyls (PCBs), phenols, pesticides and other semivolatiles. Chemical analyses were conducted by Battelle, Pacific Northwest Division, Marine Sciences Laboratory, Sequim, Washington and Twin Cities Testing, St. Paul, Minnesota. The chemical tests were run by standard or modified EPA methods. The particular EPA method used for each contaminant is provided in a report from Battelle in the enclosed appendix. According to the Battelle report, "holding times (14 days) for organic extraction were exceeded by seven days due to equipment failure at the laboratory. Samples were frozen during this period and this extension should not effect sample integrity" (PSSDA allows freezing for up to 1 year for semivolatiles).

Results/discussion

9. The raw data from the physical and chemical analyses are in the enclosed appendix. Refer to the map in figure 1 for sample locations. The north boat basin is called the "Sport Basin" and the south boat basin is called the "Commercial Basin" by locals. For the sake of brevity, sample names in this report have been shortened. For instance, from the appendix raw data, sample CHR-P-1-EPA has been shortened to CHR-1.

Physical

10. The results of physical analyses are presented in Table 1. The three samples (CHR-6,7 & 8) taken at the mouth of the Chetco River and the opening to the barge turning basin were composed of poorly graded gravel and fine sands (median grain size 25.7, 0.18, 0.21 mm) low in organic content (volatile solids 2.0-4.2%).

11. Sediments from the remaining samples in the two boat basins and upstream end of the barge turning basin were high in fines and volatile solids. These samples (CHR-1,2,3,4,5) were composed of medium to coarse silts (median grain size 0.021-0.067 mm). The fines (silt/clay) content of these samples ranged from 47.6-85.5 percent (percent passing a 230

sieve) which is typical for backwater and boat basin areas. The amount of volatile solids, a rough measure of organic content, ranged from 4.7 to 7.6 percent.

Chemical

12. The TOC content of the samples from the barge turning basin and the two boat basins ranged from 6.5 to 22.8 mg/g with a mean of 13.1 mg/g (Table 1). Generally there is a strong positive correlation between percent fines and TOC in sediments which these data support.

13. The results of metals analyses are also shown in Table 2. The concentrations of 10 metals were determined in the sediment samples. The mean concentrations of metals in the samples were somewhat higher than the means for all Oregon estuaries reported by Felstul (4) (Table 2). This was true for 7 of 8 metals for which there is comparative data (As, Cd, Cr, Cu, Hg, Ni, Pb, Zn). These values are probably within the normal range of variabilty in Oregon estuaries. Generally, the metals concentrations were not much different from those reported in a sediment evaluation conducted in 1982 by USACE (2)(also see Table 2) indicating that not much contamination has occurred in the boat basins. However, samples from the upper ends of the boat basins (CHR-1,5) seemed to have higher concentrations of metals than the other samples. These amples were highest in 6 of 8 metals detected. Sample CHR-1 from the Sport Boat Basin contained the highest concentration of mercury at 0.73 ppm. This result should be viewed with caution since matrix spike recoveries for the sample were unacceptable (see appendix, QC report).

14. Pesticides and PCB results are shown in Table 3. Pesticides were found in low concentrations in three samples. Sample CHR-3, from within the barge turning basin, contained 7.0 ppb 4',4'DDD and 4.0 ppb 4',4'DDE, both breakdown products of DDT, and 3.0 ppb endosulfan sulfate. Sample CHR-5 contained 10 ppb lindane (B-BHC) and sample CHR-8 contained 20 ppb endosulfan sulfate. None of the above mentioned pesticides were detected in the 1982 samples, except 4',4'DDE at 0.1 ppb. The 1982 samples came from the barge turning basin and upper end of the Sport Basin. The reason these particular pesticides were detected now and not in 1982 (except 4',4'DDE) is unknown but may be because of improved analytical techniques or non uniformity of contamination.

15. The PCB mixture, Arochlor 1232, was found in sample CHR-2 which was taken from the Sport Boat Basin access channel (Figure 1). The concentration of Arochlor 1232 was 277 ppb. A sample taken nearby, in an earlier sediment evaluation in 1982, contained a PCB concentration of 1.0 ppb. The detection limits for all 6 samples ranged from 27-46 ppb.

16. The samples were analyzed for 62 semivolatile organic compounds which included PAHs and phenols . The complete list of semivolatile compounds is in the raw data in the appendix. High molecular weight PAHs were found in samples CHR-2 (231 ppb pyrene) and CHR-3 (273 ppb flouranthrene, 328 ppb pyrene)(Table 4). Sample CHR-5 contained 1,042 ppb 3,3'-dichlorobenzidine, a substance used "in the manufacture of pigments for printing ink, textiles, plastics, and crayons and as a curing agent for solid urethane plastics" (5). This contaminant was detected in only 1 of the 6 samples. No phenols were detected in any of the samples, nor were any of the other semivolatiles detected.

17. The detection limits (DLs) for the semivolatiles were generally higher than the 50 to 200 ppb requested for these compounds. Unfortunately, not enough sediment or extract remained to repeat the analyses. Therefore, the information from the semivolatile analyses is compromised as many of the detection limits exceed established levels of concern.

18. Two samples were tested for TBT (Table 4). Sample CHR-1 and CHR-5 contained 69 and 47.2 ppb TBT respectively. These samples were taken at points furthest away from the entrances to the Sport and Commercial small boat basins.

19. Close examination of Tables 1-4 reveals that sample CHR-5 showed the highest fines, clay content, volatile solids and TOC of all the samples. It also was highest in 6 of 8 metals detected and contained lindane, 3,3'-dichlorobenzidine and TBT. The sample is located in a backwater area of the Commercial Boat Basin, a likely place for fines and contaminants to accumulate if present.

Quality control

20. Matrix spike and surrogate recoveries were acceptable for pesticides, PCBs, TBT and TOC (within ± 40%). Two metals fell outside control limits. According to Battelle, silver showed low matrix spike recovery due to chloride (from saltwater) interference and antimony showed low recovery, possibly because of hydride formation. The matrix spike recovery of mercury from sample CHR-1 was unacceptable for unknown reasons. However, the other samples showed good recoveries. Surrogate recoveries of semivolatiles from samples CHR-1 and 2 were unacceptable. Also, the detection limits for semivolatiles and PAHs were high ranging from 177 to 1,383 ppb. At the time of analysis standard CENPP detection limits for these compounds were 50-200 ppb. Subsequent to these analyses required detection limits have been lowered to 1-50 ppb.

Conclusions

21. Chetco River samples from within the boat basins and turning basin were highest in fines (67.1-85.8%), volatile solids (4.7-7.6 %) and TOC (11.2-22.8 mg/g). Those Chetco River samples from the mouth of the river were sandy or gravelly material lower in percent fines (0.6-12.6 %), volatile solids (2.0-4.2 %) and TOC (6.5 mg/g).

22. PCBs were detected in only one sample, CHR-2, at 277 ppb. PAHs were found in two samples - CHR-2 and 3 (total PAHs 231-601 ppb). TBT (47.2 and 69 ppb) was observed in the Commercial and Sport Boat Basins in samples CHR-1 and 5, each located at the part of the respective boat basin furthest from the entrance. Pesticides were detected in three samples, CHR-3, 5 and 8, in concentrations ranging from 3-20 ppb. The substance 3,3' dichlorobenzidine was detected in sample CHR-5. Metals concentrations in sample CHR-8, from the Federal channel near the mouth of the Chetco River, were lower than in all of the small boat basin samples. Sample CHR-5, from the Commercial Boat Basin, had higher concentrations of metals than the other samples in 6 of 8 metals detected. Sample CHR-1, from the Sport Boat Basin, showed the highest mercury level of all samples at 0.73 ppm. However, this level of mercury for sample CHR-1 is highly suspect because matrix spike recoveries in quality

sieve) which is typical for backwater and boat basin areas. The amount of volatile solids, a rough measure of organic content, ranged from 4.7 to 7.6 percent.

Chemical

12. The TOC content of the samples from the barge turning basin and the two boat basins ranged from 6.5 to 22.8 mg/g with a mean of 13.1 mg/g (Table 2). Generally there is a strong positive correlation between percent fines and TOC in sediments which these data support.

13. The results of metals analyses are ~~also~~ shown in Table 2. The concentrations of 10 metals were determined in the sediment samples. The mean concentrations of metals in the samples were somewhat higher than the means for all Oregon estuaries reported by Felstul (4) (Table 2). This was true for 7 of 8 metals for which there is comparative data (As, Cd, Cr, Cu, Hg, Ni, Pb, Zn). These values are probably within the normal range of variabilty in Oregon estuaries. Generally, the metals concentrations were not much different from those reported in a sediment evaluation conducted in 1982 by USACE (5) (also see Table 2) indicating that not much contamination has occurred in the boat basins. However, samples from the upper ends of the boat basins (CHR-1,5) seemed to have higher concentrations of metals than the other samples. These amples were highest in 6 of 8 metals detected. Sample CHR-1 from the Sport Boat Basin contained the highest concentration of mercury at 0.73 ppm. This result should be viewed with caution since matrix spike recoveries for the sample were unacceptable (see appendix, QC report).

14. Pesticides and PCB results are shown in Table 3. Pesticides were found in low concentrations in three samples. Sample CHR-3, from within the barge turning basin, contained 7.0 ppb 4',4'DDD and 4.0 ppb 4',4'DDE, both breakdown products of DDT, and 3.0 ppb endosulfan sulfate. Sample CHR-5 contained 10 ppb lindane (B-BHC) and sample CHR-8 contained 20 ppb endosulfan sulfate. None of the above mentioned pesticides were detected in the 1982 samples, except 4',4'DDE at 0.1 ppb. The 1982 samples came from the barge turning basin and upper end of the Sport Basin. The reason these particular pesticides were detected now and not in 1982 (except 4',4'DDE) is unknown but may be because of improved analytical techniques or non uniformity of contamination.

15. The PCB mixture, Arochlor 1232, was found in sample CHR-2 which was taken from the Sport Boat Basin access channel (Figure 1). The concentration of Arochlor 1232 was 277 ppb. A sample taken nearby, in an earlier sediment evaluation in 1982, contained a PCB concentration of 1.0 ppb. The detection limits for all 6 samples ranged from 27-46 ppb.

16. The samples were analyzed for 62 semivolatile organic compounds which included PAHs and phenols . The complete list of semivolatile compounds is in the raw data in the appendix. High molecular weight PAHs were found in samples CHR-2 (231 ppb pyrene) and CHR-3 (273 ppb flouranthrene, 328 ppb pyrene)(Table 4). Sample CHR-5 contained 1,042 ppb 3,3'-dichlorobenzidine, a substance used "in the manufacture of pigments for printing ink, textiles, plastics, and crayons and as a curing agent for solid urethane plastics" (5). This contaminant was detected in only 1 of the 6 samples. No phenols were detected in any of the samples, nor were any of the other semivolatiles detected.

control procedures were not acceptable and because the concentration is not in line with those of other boat basin samples which are generally in agreement.

23. Despite the interference problems with the mercury analysis for one sample and poor detection limits for the organics analyses, the data suggest that the risk of sediment contamination is low and confined to the small boat basins. Additional testing, including possible biological testing, may be needed prior to dredging and disposal of material from the two basins, particularly the upper ends (CHR-1 and CHR-5). Material associated with the entrance channel is predominantly sand and gravel. Additional chemical or biological testing is not considered necessary in the immediate future.

Table 1.

Results of physical analyses of Chetco River sediment.

sample	grain size	fines	clay	volatile solids	TOC
	mm	%			mg/g
CHR-1	0.021	73.0	8.6	5.7	11.2
CHR-2	0.026	78.4	10.2	6.3	15.6
CHR-3	0.026	67.1	12.3	4.7	10.9
CHR-4	0.067	47.6	7.8	5.8	11.6
CHR-5	0.028	85.8	22.1	7.6	22.8
CHR-6	25.7	0.6	-	-	-
CHR-7	0.180	0.4	-	2.0	-
CHR-8	0.210	12.6	-	4.2	6.5

Table 1.

Results of physical analyses of Chetco River sediment.

sample	grain size	fines	clay	volatile solids	TOC
	mm	%			mg/g
CHR-1	0.021	73.0	8.6	5.7	11.2
CHR-2	0.026	78.4	10.2	6.3	15.6
CHR-3	0.026	67.1	12.3	4.7	10.9
CHR-4	0.067	47.6	7.8	5.8	11.6
CHR-5	0.028	85.8	22.1	7.6	22.8
CHR-6	25.7	0.6	-	-	-
CHR-7	0.180	0.4	-	2.0	-
CHR-8	0.210	12.6	-	4.2	6.5

Table 2.

Concentrations of metals in Chetco River sediment samples.

sample	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Sb	Zn
					ppm					
CHR-1	ND	8.6	0.76	66	89	0.73†	86	19.4	ND	144
CHR-2	ND	7.6	0.60	66	36	0.07	92	6.5	ND	97
CHR-3	ND	7.7	0.64	74	35	0.14	84	6.9	ND	100
CHR-4	ND	7.9	0.69	69	35	0.08	87	9.6	ND	99
CHR-5	ND	9.6	0.78	86	112	0.12	100	12.0	ND	162
CHR-8	ND	7.1	0.41	48	24	0.05	82	6.4	ND	72
mean	-	8.1	0.65	68	55	0.20	89	10.1	-	112
1982*	-	8.5	N.C.^	20	55	0.15	-	15.0	-	63
Oregon's Estuaries	-	6.6	0.42	29	24	0.05	29	14.1	-	84

† - Suspect because of unacceptable matrix spike recoveries.

* - Based on two samples from the Sport Boat Basin.

^ - Not Comparable. The 1982 samples were measured for cadmium by flame AA which always leads to higher values than GFAA. The 1982 cadmium value was 3.00 ppm.

Table 3.

Concentrations of detected pesticides and PCBs in Chetco River sediment samples.

sample	PCBs	Pesticides			
		DDD	DDE	Endosulfan Sulfate	B-BHC
		ppb			
CHR-2	277	ND	ND	ND	ND
CHR-3	ND	7	4	3	ND
CHR-5	ND	ND	ND	ND	10
CHR-8	ND	ND	ND	20	ND

Table 4.

Concentrations of detected PAHs, semi-volatiles and TBT in Chetco River sediment samples.

sample	fluoranthene	pyrene	3,3'-dichlorobenzidine	TBT
	ppb			
CHR-1	ND	ND	ND	69
CHR-2	ND	231	ND	*
CHR-3	273	328	ND	*
CHR-5	ND	ND	1,042	47.2

* not measured

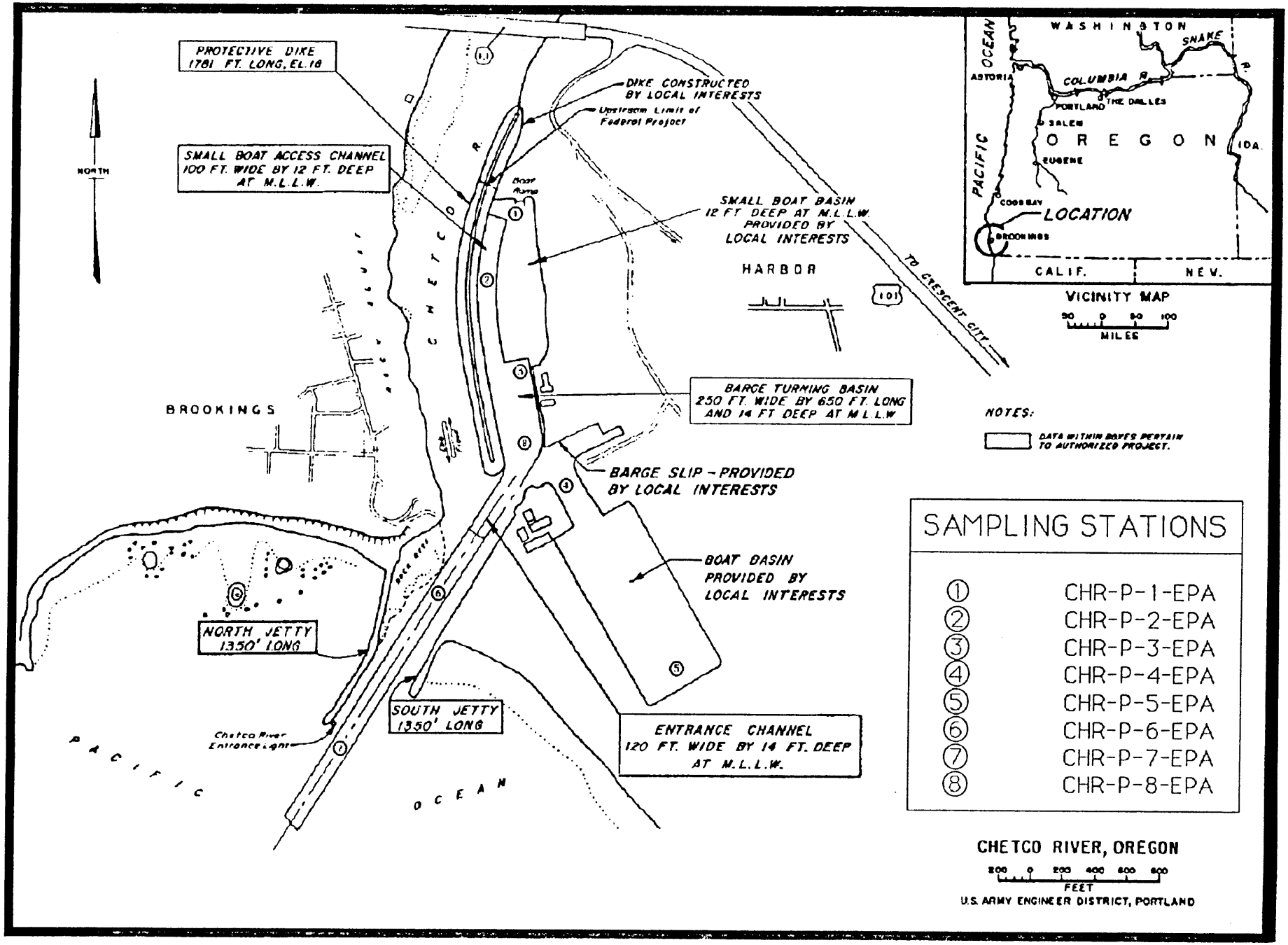

PROTECTIVE DIKE
1781 FT. LONG, EL. 18
DIKE CONSTRUCTED BY LOCAL INTERESTS
Upstream Limit of Federal Project
SMALL BOAT ACCESS CHANNEL
100 FT. WIDE BY 12 FT. DEEP
AT M.L.L.W.
NORTH
Boat Ramp
SMALL BOAT BASIN
12 FT. DEEP AT M.L.L.W.
PROVIDED BY
LOCAL INTERESTS
HARBOR
TO CRESCENT CITY
101
BROOKINGS
BARGE TURNING BASIN
250 FT. WIDE BY 650 FT. LONG
AND 14 FT. DEEP AT M.L.L.W.
BARGE SLIP - PROVIDED
BY LOCAL INTERESTS
BOAT BASIN
PROVIDED BY
LOCAL INTERESTS
NORTH JETTY
1350' LONG
SOUTH JETTY
1350' LONG
Chetco River
Entrance Light
ENTRANCE CHANNEL
120 FT. WIDE BY 14 FT. DEEP
AT M.L.L.W.
PACIFIC
OCEAN
CHETCO R.
WASHINGTON
SNAKE R.
ASTORIA
COLUMBIA R.
PORTLAND
THE DALLES
SALEM
OREGON
EUGENE
COOS BAY
LOCATION
BROOKINGS
CALIF.
NEV.
IDA.
VICINITY MAP
50 0 50 100
MILES
NOTES:
DATA WITHIN BOXES PERTAIN TO AUTHORIZED PROJECT.
SAMPLING STATIONS
① CHR-P-1-EPA
② CHR-P-2-EPA
③ CHR-P-3-EPA
④ CHR-P-4-EPA
⑤ CHR-P-5-EPA
⑥ CHR-P-6-EPA
⑦ CHR-P-7-EPA
⑧ CHR-P-8-EPA
CHETCO RIVER, OREGON
200 0 200 400 600 800
FEET
U.S. ARMY ENGINEER DISTRICT, PORTLAND

FIGURE 1

REFERENCES

1. Percy, K. , Bella, D., Sutterlin, C. and Klingeman, P. 1974. Oregon's estuaries. Sea Grant College Program, Oregon State University, Corvallis, Oregon.

2. U.S. Army Corps of Engineers, Portland District. 1982. Sediment physical and chemical characteristics Chetco River federal navigation project.

3. U.S. Army Corps of Engineers, Portland District. 1988. Chetco ocean dredged material disposal site evaluation.

4. Felstul, D. 1987. Tiered testing plan for metals in Oregon sediments. U.S. Army Corps of Engineers.

5. Sittig, M. 1981. Handbook of toxic and hazardous chemicals. Noyes Publications, Park Ridge, New Jersey.

APPENDIX

CHETCO RIVER BOAT BASIN (EPA)

Results of Dredge Test Analysis

CENPP Sample No.	Resuspended Density,gms/L	Void Ratio	Volatile Solids,%	Specific Gravity	Particle Roundness Grading
CHR-P-6-EPA	*	*	*	*	*
CHR-P-7-EPA	1804	1.125	2.0	2.71	subangular to subround
CHR-P-8-EPA	1609	1.780	4.2	2.69	subangular to subround

* NOTE : Insufficient material for dredge test analyses

Received : 21 Aug 90

* * * Corps of Engineers - North Pacific Division Materials Laboratory * * *

CHETCO RIVER BOAT BASIN (EPA) (90-SH-183)

Boring: -- Sample: **CHR-P-1** Depth: **SURFACE** Lab No.: 18301

------ Sieve Analysis ------

Sieve	Cumulative Grams Retained	Percent Passing
5 In.	0.00	100.0
2.5 In.	0.00	100.0
1.25 In.	0.00	100.0
5/8 In.	0.00	100.0
5/16 In.	0.00	100.0
No. 5	0.00	100.0
No. 10	1.10	99.7
Pan	341.40	0.0
No. 18	0.70	99.1
No. 35	3.40	97.0
No. 60	12.80	~~89.7~~
No. 120	20.50	83.7
No. 230	34.10	~~73.0~~
Pan	127.60	0.0

---------- Hydrometer Analysis ----------

Sample Weight:65.1 gr. Start Time:0000

Time	Temp (C)	Hydrometer Reading	Diameter in mm	Percent Finer
1	20.0	42.5	0.0409	65.2
3	20.0	35.5	0.0250	54.6
10	20.0	25.5	0.0148	39.4
100	20.0	10.2	0.0066	16.2
200	20.0	5.2	0.0048	8.6

$\bar{x} = 0.056$

D85: 0.14 D60: .032 D50: .021 D30: .011 D15: .0063 D10: .0051 mm

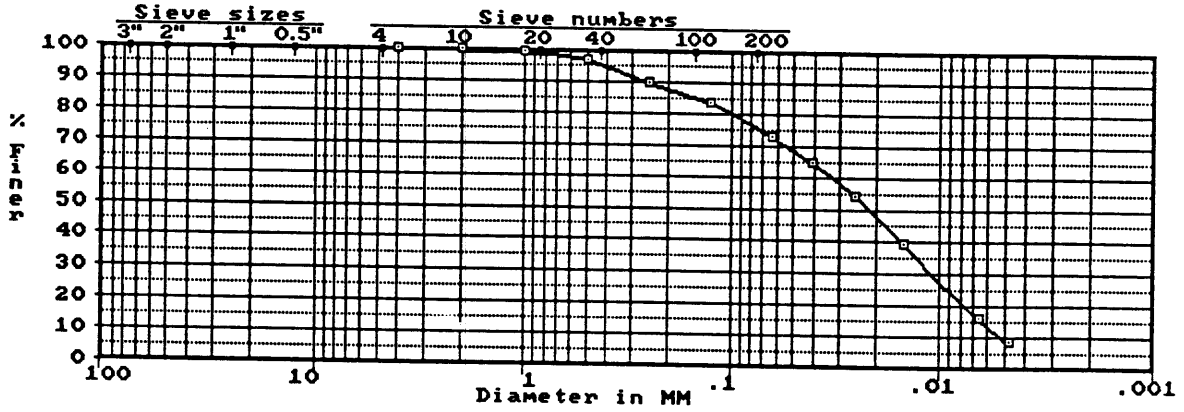
Cu: 6.20 Cc: 0.72

Gravel: 0.0% Sand: 24.0% Fines: 76.0%

---------- Comments ----------

- PONAR GRAB SAMPLE
- BOTTOM SEDIMENTS
- VOLATILE SOLIDS = 5.7%

Cannot classify soil without knowing type of fines.



* * * Corps of Engineers - North Pacific Division Materials Laboratory * * *

CHETCO RIVER BOAT BASIN (EPA) (90-SH-183)

Boring: -- Sample: CHR-P-2 Depth: SURFACE Lab No.: 18302

------ Sieve Analysis ------

Sieve	Cumulative Grams Retained	Percent Passing
5 In.	0.00	100.0
2.5 In.	0.00	100.0
1.25 In.	0.00	100.0
5/8 In.	0.00	100.0
5/16 In.	0.00	100.0
No. 5	0.00	100.0
No. 10	0.20	99.9
Pan	331.30	0.0
No. 18	0.10	99.9
No. 35	0.40	99.7
No. 60	3.80	97.5
No. 120	7.40	95.2
No. 230	33.90	78.4
Pan	157.10	0.0

---------- Hydrometer Analysis ----------

Sample Weight:63.2 gr. Start Time:0000

Time	Temp (C)	Hydrometer Reading	Diameter in mm	Percent Finer
1	20.0	40.2	0.0418	63.7
3	20.0	31.2	0.0259	49.6
10	20.0	22.2	0.0151	35.5
100	20.0	9.5	0.0066	15.7
200	20.0	6.0	0.0048	10.2

$\bar{X} = 0.037$

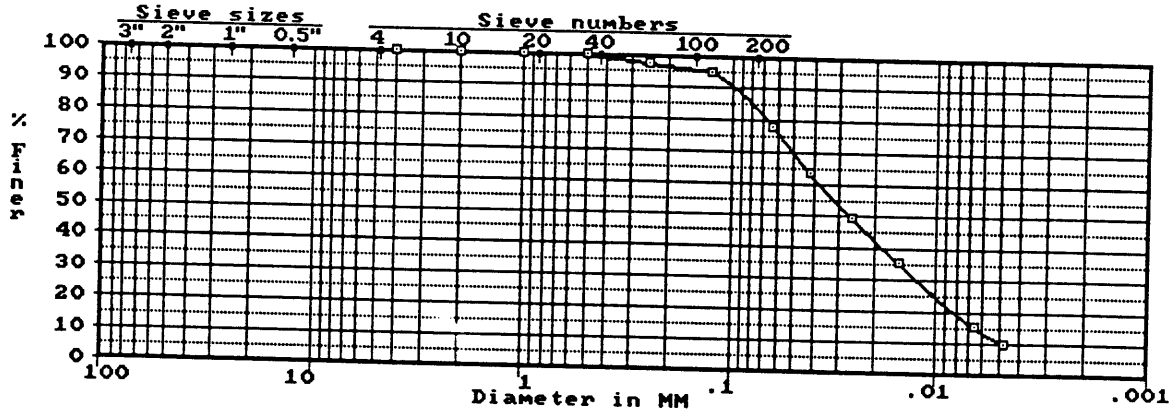
D85: .078 D60: .037 D50: .026 D30: .012 D15: .0064 mm

Gravel: 0.0% Sand: 16.2% Fines: 83.8%

---------- Comments ----------

- PONAR GRAB SAMPLE
- BOTTOM SEDIMENTS
- VOLATILE SOLIDS = 6.3%

Cannot classify soil without knowing type of fines.



* * * Corps of Engineers - North Pacific Division Materials Laboratory * * *

CHETCO RIVER BOAT BASIN (EPA) (90-SH-183)

Boring: -- Sample: CHR-P-3 Depth: SURFACE Lab No.: 18303

------ Sieve Analysis ------

Sieve	Cumulative Grams Retained	Percent Passing
5 In.	0.00	100.0
2.5 In.	0.00	100.0
1.25 In.	0.00	100.0
5/8 In.	0.00	100.0
5/16 In.	2.10	99.5
No. 5	3.20	99.3
No. 10	7.70	98.2
Pan	429.50	0.0
No. 18	1.80	97.0
No. 35	6.30	94.1
No. 60	21.50	84.1
No. 120	34.80	75.4
No. 230	47.60	67.1
Pan	150.10	0.0

---------- Hydrometer Analysis ----------

Sample Weight: 71.4 gr. Start Time: 0000

Time	Temp (C)	Hydrometer Reading	Diameter in mm	Percent Finer
1	20.0	42.4	0.0410	58.4
3	20.0	35.4	0.0251	48.9
10	20.0	25.5	0.0148	35.4
100	20.0	12.5	0.0065	17.7
200	20.0	8.5	0.0047	12.3

$\bar{X} = 0.097$

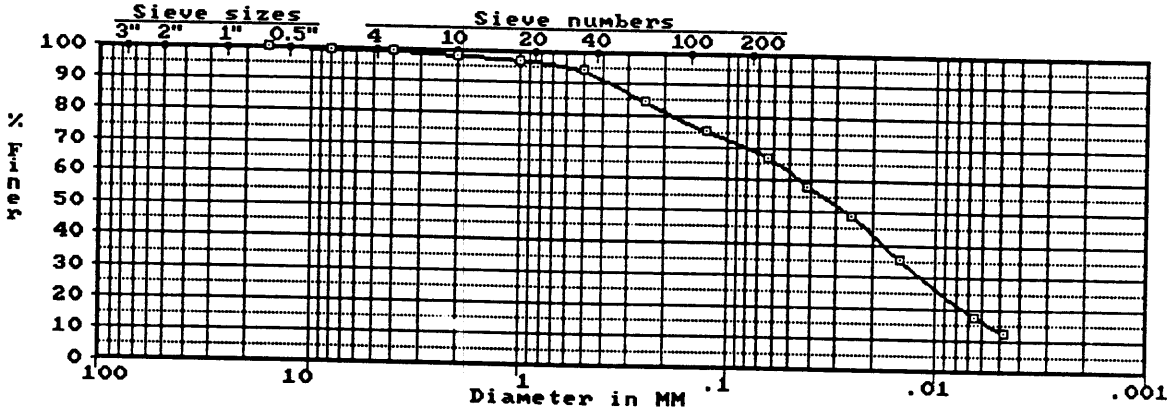
D85: 0.26 D60: .044 D50: .026 D30: .012 D15: .0056 mm

Gravel: 0.6% Sand: 29.9% Fines: 69.5%

---------- Comments ----------

- PONAR GRAB SAMPLE
- BOTTOM SEDIMENTS
- VOLATILE SOLIDS = 4.7%

Cannot classify soil without knowing type of fines.



* * * Corps of Engineers - North Pacific Division Materials Laboratory * * *

CHETCO RIVER BOAT BASIN (EPA) (90-SH-183)

Boring: -- Sample: CHR-P-4 Depth: SURFACE Lab No.: 18304

------ Sieve Analysis ------

Sieve	Cumulative Grams Retained	Percent Passing
5 In.	0.00	100.0
2.5 In.	0.00	100.0
1.25 In.	0.00	100.0
5/8 In.	0.00	100.0
5/16 In.	0.00	100.0
No. 5	0.90	99.7
No. 10	1.00	99.7
Pan	343.70	0.0
No. 18	0.10	99.6
No. 35	0.60	99.2
No. 60	5.90	95.1
No. 120	29.30	77.0
No. 230	67.20	47.6
Pan	128.50	0.0

$\bar{X} = 0.08$

---------- Hydrometer Analysis ----------

Sample Weight: 59.7 gr. Start Time: 0000

Time	Temp (C)	Hydrometer Reading	Diameter in mm	Percent Finer
1	20.0	23.5	0.0473	39.7
3	20.0	15.5	0.0287	26.5
10	20.0	10.2	0.0162	17.7
100	20.0	5.2	0.0068	9.4
200	20.0	4.2	0.0048	7.8

D85: 0.16 D60: .085 D50: .067 D30: .033 D15: .013 D10: .0075 mm

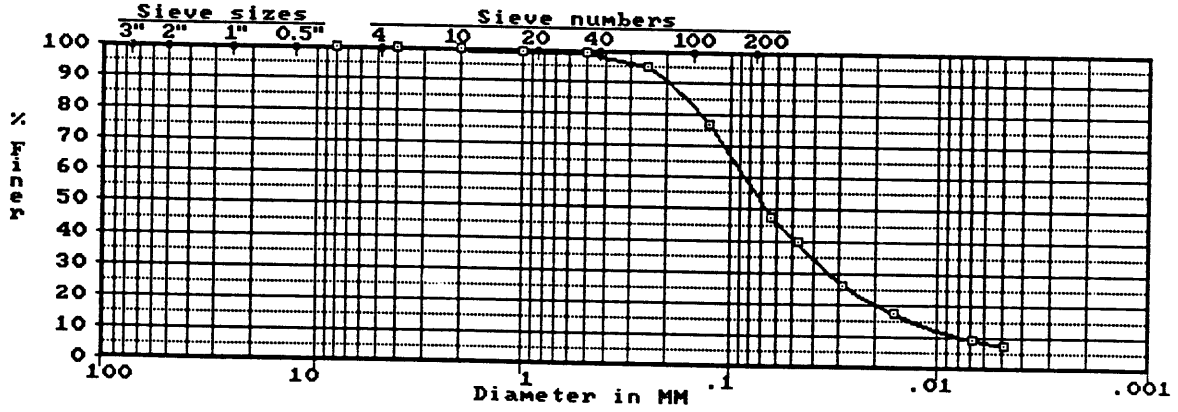
Cu: 11.3 Cc: 1.74

Gravel: 0.2% Sand: 44.8% Fines: 54.9%

---------- Comments ----------

- PONAR GRAB SEDIMENTS
- BOTTOM SEDIMENTS
- VOLATILE SOLIDS = 5.8%

Cannot classify soil without knowing type of fines.



* * * Corps of Engineers - North Pacific Division Materials Laboratory * * *

CHETCO RIVER BOAT BASIN (EPA) (90-SH-183)

Boring: -- Sample: CHR-P-5 Depth: **SURFACE** Lab No.: 18305

------ Sieve Analysis ------

Sieve	Cumulative Grams Retained	Percent Passing
5 In.	0.00	100.0
2.5 In.	0.00	100.0
1.25 In.	0.00	100.0
5/8 In.	0.00	100.0
5/16 In.	0.00	100.0
No. 5	0.00	100.0
No. 10	0.00	100.0
Pan	134.30	0.0
No. 18	0.00	100.0
No. 35	1.00	99.3
No. 60	6.10	95.5
No. 120	9.30	93.1
No. 230	19.10	85.8
Pan	134.30	0.0

---------- Hydrometer Analysis ----------

Sample Weight:62.6 gr. Start Time:0000

Time	Temp (C)	Hydrometer Reading	Diameter in mm	Percent Finer
1	20.0	45.2	0.0400	72.3
3	20.0	35.2	0.0251	56.5
10	20.0	25.3	0.0148	40.8
100	20.0	15.5	0.0064	25.3
200	20.0	13.5	0.0046	22.1

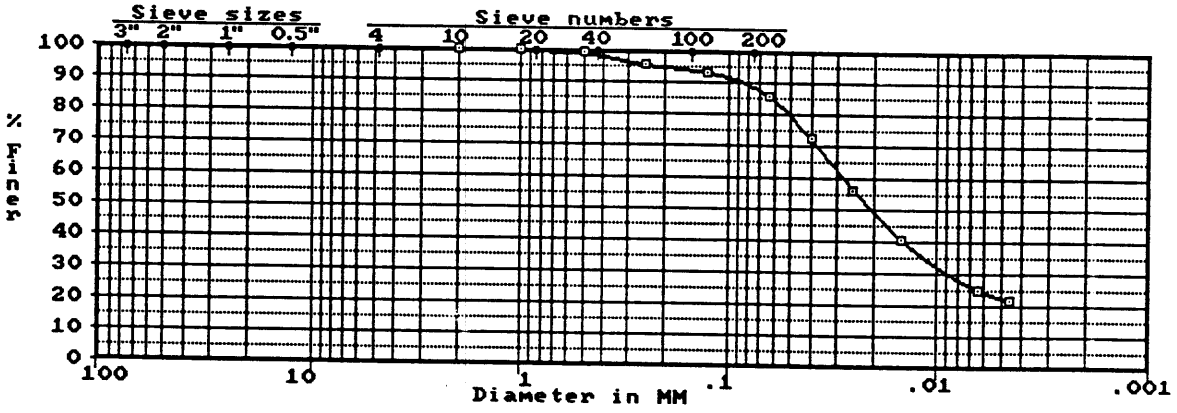
D85: .061 D60: .028 D50: .020 D30: .0089 mm

Gravel: 0.0% Sand: 11.4% Fines: 88.6%

---------- Comments ----------

- PONAR GRAB SAMPLE
- BOTTOM SEDIMENTS
- VOLATILE SOLIDS = 7.6%

Cannot classify soil without knowing type of fines.



* * * Corps of Engineers - North Pacific Division Materials Laboratory * * *

CHETCO RIVER BOAT BASIN (EPA) (90-SH-183)

Boring: -- Sample: CHR-P-6 Depth: SURFACE Lab No.: 18306

------ Sieve Analysis ------

Sieve	Cumulative Grams Retained	Percent Passing
5 In.	0.00	100.0
2.5 In.	0.00	100.0
1.25 In.	302.50	64.3
5/8 In.	669.90	21.0
5/16 In.	820.30	3.3
No. 5	837.40	1.3
No. 10	839.10	1.1
Pan	848.20	0.0
No. 18	0.30	1.0
No. 35	0.60	1.0
No. 60	1.10	0.9
No. 120	1.90	0.8
No. 230	3.70	0.6
Pan	8.90	0.0

No hydrometer analysis.

$\bar{X} = 28.4$

D85: 45.9 D60: 29.9 D50: 25.7 D30: 18.6 D15: 13.5 D10: 11.5 mm

Cu: 2.61 Cc: 1.01

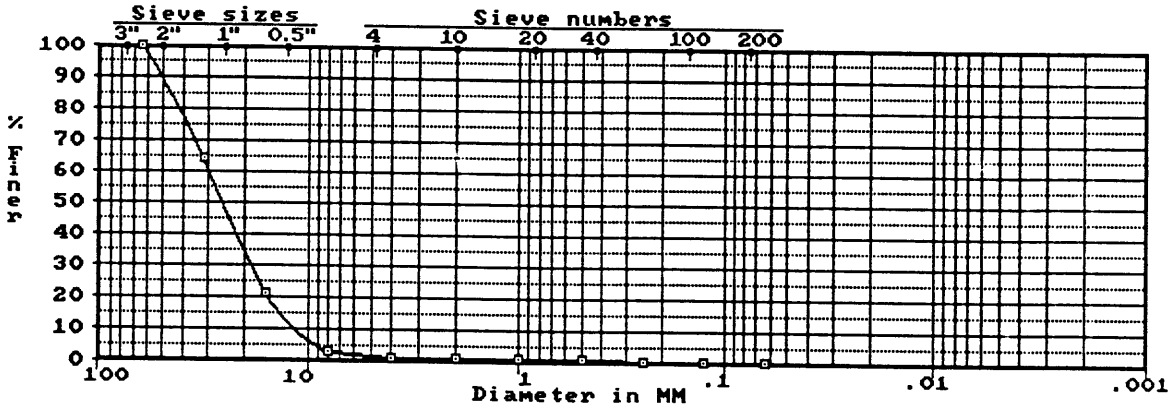
Gravel: 98.2% Sand: 1.1% Fines: 0.7%

---------- ASTM D 2487 Classification ----------

GP Poorly graded GRAVEL

---------- Comments ----------

- SAMPLED 18 AUG 90
- PONAR GRAB SAMPLE
- BOTTOM SEDIMENTS
- NOT ENOUGH MATERIAL TO COMPLETE DREDGE SERIES



* * * Corps of Engineers - North Pacific Division Materials Laboratory * * *

CHETCO RIVER BOAT BASIN (EPA) (90-SH-183)

Boring: -- Sample: CHR-P-7 Depth: SURFACE Lab No.: 18307

------ Sieve Analysis ------

Sieve	Cumulative Grams Retained	Percent Passing
5 In.	0.00	100.0
2.5 In.	0.00	100.0
1.25 In.	0.00	100.0
5/8 In.	0.00	100.0
5/16 In.	6.70	99.3
No. 5	10.70	98.8
No. 10	15.20	98.3
Pan	895.80	0.0
No. 18	1.70	97.1
No. 35	4.20	95.4
No. 60	16.70	86.6
No. 120	121.30	13.1
No. 230	139.40	0.4
Pan	140.00	0.0

No hydrometer analysis.

$\bar{X} = 0.187$

D85: 0.25 D60: 0.19 D50: 0.18 D30: 0.15 D15: 0.13 D10: 0.11 mm

Cu: 1.84 Cc: 1.04

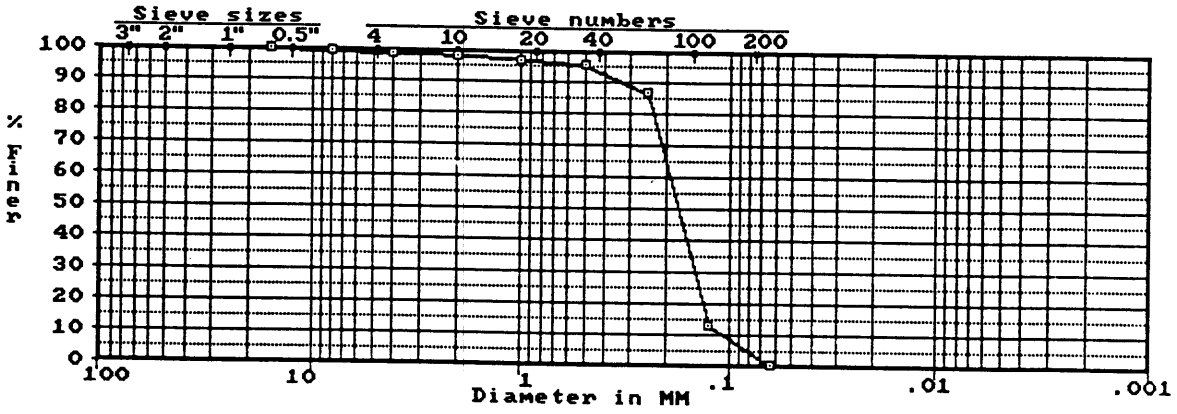
Gravel: 1.1% Sand: 95.3% Fines: 3.6%

---------- ASTM D 2487 Classification ----------

SP Poorly graded SAND

---------- Comments ----------

- SAMPLED 18 AUG 90
- PONAR GRAB SAMPLE
- BOTTOM SEDIMENTS
- VOLATILE SOLIDS = 2.0%



* * * Corps of Engineers - North Pacific Division Materials Laboratory * * *

CHETCO RIVER BOAT BASIN (EPA) (90-SH-183)

Boring: -- Sample: **CHR-P-8** Depth: **SURFACE** Lab No.: 18308

------ Sieve Analysis ------

Sieve	Cumulative Grams Retained	Percent Passing
5 In.	0.00	100.0
2.5 In.	0.00	100.0
1.25 In.	0.00	100.0
5/8 In.	9.30	97.5
5/16 In.	19.90	94.6
No. 5	21.20	94.2
No. 10	22.60	93.8
Pan	365.60	0.0
No. 18	1.10	92.9
No. 35	7.00	88.2
No. 60	42.50	59.7
No. 120	83.00	27.2
No. 230	101.20	12.6
Pan	116.90	0.0

No hydrometer analysis.

$\bar{X} = 0.246$

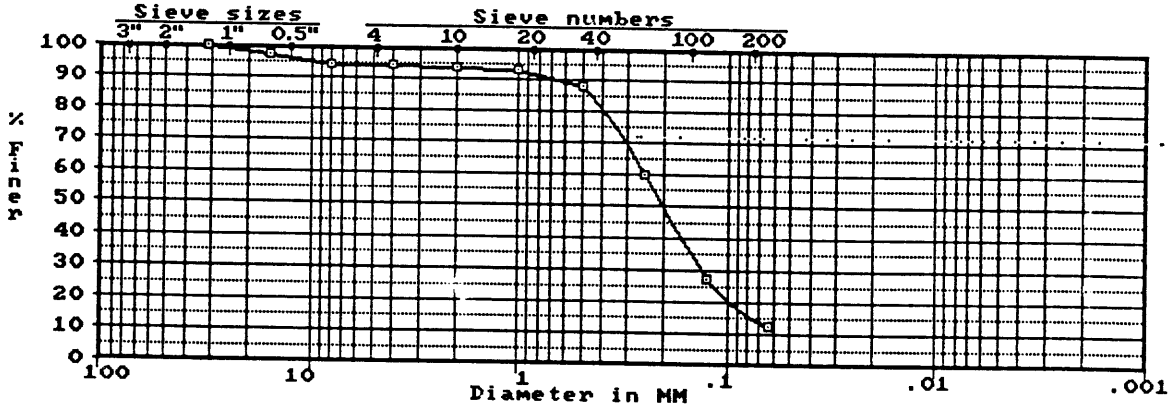
D85: 0.45 D60: 0.25 D50: 0.21 D30: 0.13 D15: .077 mm

Gravel: 5.7% Sand: 79.6% Fines: 14.7%

---------- Comments ----------

- SAMPLED 18 AUG 9
- PONAR GRAB SAMPLE
- BOTTOM SEDIMENTS
- VOLATILE SOLIDS = 4.2%

Cannot classify soil without knowing type of fines.



Battelle
Pacific Northwest Division
Marine Sciences Laboratory
439 West Sequim Bay Road
Sequim, Washington 98382
(206) 683-4151

December 4, 1990

Mr. Mark Siipola
U.S. Army Corps of Engineers
Portland District
319 S.W. Pine
CENPP-PL-CH
Portland, Oregon 97208-2946

Dear Mark:

The following is a summary of the results of chemical analyses of six Chetco River sediment samples. Samples were received on August 22, 1990 by Battelle. Samples were subsequently split for the requested chemical analyses including metals, Total Organic Carbon (TOC), Butyltins, PCBs and Chlorinated Pesticides and Base/Neutral/Acid Extractable organic compounds (BNAs). All parameters except for the butyltins were analyzed at Twin City Testing in St. Paul, Minnesota. All results are presented on a dry-weight basis. Specific units are defined on the data tables.

ANALYTICAL METHODS

The following methods were used to analyze the sediments described above:

Metals - Sediments were digested according to EPA Method 3020 or 3050 listed in EPA Test Methods for Evaluating Solid Wastes, SW-846. Method 3020 digests were screened for all metals using EPA Method 6010, Inductively Coupled Argon Plasma Spectrometer Method (ICAP). Chromium, copper, nickel and zinc were subsequently quantified using ICAP. Arsenic and Antimony were also run using ICAP, but were analyzed using the hydride procedure according to EPA Contract Laboratory Procedure Method 200.62-C-CLP (Special Analytical Services). This procedure was modified by Twin City Testing to work with a Thermo Jarrel Ash ICAP Spectrometer. Method 3050 digests were analyzed for the remaining metals using Graphite Furnace Atomic Absorption Spectrometer (GFAA). Specific EPA methods for these metals include Method 7760 for silver, Method 5131 for cadmium, Method 7421 for lead, and Method 7471 for mercury.

Total Organic Carbon - Total Organic Compound was analyzed using a DC-80 Total Carbon Analyzer equipped with a sludge and sediment sampler accessory.

Butyltins - Butyltins were extracted using methylene chloride and analyzed using Gas Chromatography/Flame Photoionization Detection (GC/FPD).

PCBs/Pesticides - Sediment samples were extracted according to EPA Method 3540 using methylene chloride, followed by an alumina and copper clean-up. PCBs and chlorinated pesticides were analyzed using Gas Chromatography/Electron Capture Detection (GC/ECD) according to Method 8080 listed in EPA Test Methods for Evaluating Solid Wastes, SW-846. All positive identifications were confirmed using a second dissimilar column.

Base/Neutral and Acid Extractable Compounds - Sediment samples were extracted according to EPA Method 3540 using methylene chloride. Extracts were analyzed for BNA semivolatile organic compounds using Gas Chromatography/Mass Spectrometry (GC/MS).

Originally, volatile organic compound analyses were requested for two sediment samples. Samples were not collected initially in the appropriate container for volatile analyses. After subsequent handling of the sample for subsampling for other requested analyses, we felt that the sample was not suitable for analysis of volatile organics.

QUALITY CONTROL

Quality control data includes method blanks, surrogate recoveries, duplicate analyses and matrix spike recoveries. Blanks, duplicates and surrogate recovery data are included on the data tables. Matrix spike data are presented in separate tables. (Note, the matrix spike results provided in separate tables are presented on a wet-weight basis.)

In general, data quality was acceptable. Holding times for organic extraction were exceeded by seven days due to equipment failure at the laboratory. Samples were frozen during this period and this extension should not effect sample integrity.

Low semivolatile organic surrogate recoveries were observed for two samples, CHR-P-1 and CHR-P-2. These low recoveries were found for three of the six surrogates. These particular surrogates represent the more volatile compounds and were a result of over-concentration at the lab. Normally, these samples would have been re-extracted and re-analyzed but limited sample size prevented this. Based on the results available, little or no semivolatile organic compounds were found in any of the sediments from the Chetco River and, therefore, some loss of the more volatile range of compounds during analysis of the two samples mentioned above is not expected to be serious.

Overall, metals data is acceptable. Some inconsistencies were observed for mercury recoveries in the matrix spikes. All samples were spiked with mercury and recoveries were generally within the ±40% control limits, with the exception of sample CHR-P-1. Repetitive spikes showed recoveries from -300 to 160%. It is unclear why this was the case.

Silver recovery in the matrix spike was low. This was most likely due to the presence of chloride (saltwater), which causes a negative bias in the determination of silver content by the method used. Antimony recovery was also low and was thought to be caused by matrix interferences in association with hydride formation in the method.

Sincerely,

Eric A. Crecelius
Senior Research Scientist

Enclosures

SEDIMENT DATA
Project: CHETCO RIVER
Sponsor: Portland COE

11/30/90

SEDIMENT METAL DATA

(Concentrations in mg/kg DRY WT.)

SPONSOR Code	LAB Code	% MOISTURE	Ag		As		Cd	Cr	Cu	Hg	Ni	Pb	Sb		Zn
CHR-P-1-EPA	214444	38.10%	0.20	U	8.6		0.76	66	89	0.73	86	19.4	0.2	U	144
CHR-P-2-EPA	214449	35.10%	0.19	U	7.6		0.60	66	37	0.07	92	6.5	0.2	U	97
CHR-P-3-EPA	214451	26.80%	0.17	U	8.5		0.45	58	36	0.14	89	6.8	0.1	U	102
CHR-P-3-EPA DUPL	214451	26.80%	0.17	U	6.8		0.82	79	33	NA	78	7.0	0.1	U	97
CHR-P-4-EPA	214453	29.00%	0.18	U	7.9		0.69	69	35	0.08	87	9.6	0.1	U	99
CHR-P-5-EPA	214455	50.10%	0.25	U	9.6		0.78	86	112	0.12	100	12.0	0.2	U	162
CHR-P-8-EPA	214456	26.40%	0.17	U	7.1		0.41	48	24	0.05	82	6.4	0.1	U	72

U indicates analyte not detected at detection limit shown.

NA indicates analyte was not analyzed.

SEDIMENT DATA
Project: CHETCO RIVER
Sponsor: Portland COE

12/3/90

SEMIVOLATILE ORGANIC COMPOUNDS

(Concentrations in ug/kg Dry Wt.)

Sponsor Code :	CHR-P-1-EPA	CHR-P-2-EPA	CHR-P-3-EPA	CHR-P-4-EPA	CHR-P-5-EPA	CHR-P-8-EPA	
TCT Code :	214444	214449	214451	214453	214455	214456	METHOD
% MOISTURE:	38.10%	35.10%	26.80%	29.00%	50.10%	26.40%	BLANK
	0.619	0.649	0.732	0.71	0.499	0.736	

PHENOL	210 U	200 U	178 U	183 U	281 U	177 U	130 U
BIS(2-CHLOROETHYL)ETHER	210 U	200 U	178 U	183 U	281 U	177 U	130 U
2-CHLOROPHENOL	210 U	200 U	178 U	183 U	281 U	177 U	130 U
1,3-DICHLOROBENZENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
1,4-DICHLOROBENZENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
BENZYL ALCOHOL	210 U	200 U	178 U	183 U	281 U	177 U	130 U
1,2-DICHLOROBENZENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
2-METHYLPHENOL	210 U	200 U	178 U	183 U	281 U	177 U	130 U
BIS(2-CHLOROISOPROPYL)ETHER	210 U	200 U	178 U	183 U	281 U	177 U	130 U
4-METHYLPHENOL	210 U	200 U	178 U	183 U	281 U	177 U	130 U
N-NITROSO-DI-N-PROPYLAMINE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
HEXACHLOROETHANE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
NITROBENZENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
ISOPHORONE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
2-NITROPHENOL	210 U	200 U	178 U	183 U	281 U	177 U	130 U
2,4-DIMETHYLPHENOL	210 U	200 U	178 U	183 U	281 U	177 U	130 U
BENZOIC ACID	1066 U	1017 U	902 U	930 U	1383 U	897 U	660 U
BIS(2-CHLOROETHOXY)METHANE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
2,4-DICHLOROPHENOL	210 U	200 U	178 U	183 U	281 U	177 U	130 U
1,2,4-TRICHLOROBENZENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
NAPHTHALENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
4-CHLOROANILINE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
HEXACHLOROBUTADIENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
4-CHLORO-3-METHYLPHENOL	210 U	200 U	178 U	183 U	281 U	177 U	130 U
2-MTHYLNAPHTHALENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
HEXACHLOROCYCLOPENTADIENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
2,4,6-TRICHLOROPHENOL	210 U	200 U	178 U	183 U	281 U	177 U	130 U
2,4,5-TRICHLOROPHENOL	1066 U	1017 U	902 U	930 U	1383 U	897 U	660 U
2-CHLORONAPHTHALENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
2-NITROANILINE	1066 U	1017 U	902 U	930 U	1383 U	897 U	660 U
DIMETHYL PHTHALATE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
ACENAPHTHALENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
3-NITROANILINE	1066 U	1017 U	902 U	930 U	1383 U	897 U	660 U
ACENAPHTHENE	210 U	200 U	178 U	183 U	281 U	177 U	330 U

SEDIMENT DATA
Project: CHETCO RIVER
Sponsor: Portland COE

11/30/90

SEDIMENT PCB DATA

(Concentrations in ug/kg Dry Wt.)

Sponsor Code :	CHR-P-1-EPA	CHR-P-2-EPA	CHR-P-3-EPA	CHR-P-4-EPA	CHR-P-5-EPA	CHR-P-8-EPA	METHOD BLANK
TCT Code :	214444	214449	214451	214453	214455	214456	
% MOISTURE:	38.10%	35.10%	26.80%	29.00%	50.10%	26.40%	
PCBS							
AROCLOR 1016	32 U	31 U	27 U	28 U	46 U	27 U	20 U
AROCLOR 1221	32 U	31 U	27 U	28 U	46 U	27 U	20 U
AROCLOR 1232	32 U	277	27 U	28 U	46 U	27 U	20 U
AROCLOR 1242	32 U	31 U	27 U	28 U	46 U	27 U	20 U
AROCLOR 1248	32 U	31 U	27 U	28 U	46 U	27 U	20 U
AROCLOR 1254	32 U	31 U	27 U	28 U	46 U	27 U	20 U
AROCLOR 1260	32 U	31 U	27 U	28 U	46 U	27 U	20 U

SEDIMENT PESTICIDE DATA

(Concentrations in ug/kg Dry Wt.)

Sponsor Code :	CHR-P-1-EPA	CHR-P-2-EPA	CHR-P-3-EPA	CHR-P-4-EPA	CHR-P-5-EPA	CHR-P-8-EPA	METHOD BLANK
TCT Code :	214444	214449	214451	214453	214455	214456	
% MOISTURE:	38.10%	35.10%	26.80%	29.00%	50.10%	26.40%	
PESTICIDES							
ALDRIN	3 U	3 U	3 U	3 U	4 U	3 U	2 U
A-BHC	3 U	3 U	3 U	3 U	4 U	3 U	2 U
B-BHC	3 U	3 U	3 U	3 U	10	3 U	2 U
D-BHC	3 U	3 U	3 U	3 U	4 U	3 U	2 U
CHLORDANE	3 U	3 U	3 U	3 U	4 U	3 U	2 U
4,4'DDD	3 U	3 U	7	3 U	4 U	3 U	2 U
4,4'DDE	3 U	3 U	4	3 U	4 U	3 U	2 U
4,4'DDT	3 U	3 U	3 U	3 U	4 U	3 U	2 U
ENDOSULFAN I	3 U	3 U	3 U	3 U	4 U	3 U	2 U
ENDOSULFAN II	3 U	3 U	3 U	3 U	4 U	3 U	2 U
EDOSULFAN SULFATE	3 U	3 U	3	3 U	4 U	20	2 U
ENDIRN	3 U	3 U	3 U	3 U	4 U	3 U	2 U
ENDIRN ALDEHYDE	3 U	3 U	3 U	3 U	4 U	3 U	2 U
HEPTACHLOR	3 U	3 U	3 U	3 U	4 U	3 U	2 U
HEPTACHLOR EPOXIDE	3 U	3 U	3 U	3 U	4 U	3 U	2 U
LINDANE (G-BHC)	3 U	3 U	3 U	3 U	4 U	3 U	2 U
TOXAPHENE	3 U	3 U	3 U	3 U	4 U	3 U	2 U
METHOXYCHLOR	6 U	6 U	5 U	6 U	8 U	5 U	4 U
ENRIN KETONE	3 U	3 U	3 U	3 U	4 U	3 U	2 U
SURROGATE RECOVERY (DBC):	110%	110%	110%	130%	81%	74%	120%

SEDIMENT DATA
Project: CHETCO RIVER
Sponsor: Portland COE

12/3/90

SEMIVOLATILE ORGANIC COMPOUNDS

(Concentrations in ug/kg Dry Wt.)

Sponsor Code :	CHR-P-1-EPA	CHR-P-2-EPA	CHR-P-3-EPA	CHR-P-4-EPA	CHR-P-5-EPA	CHR-P-8-EPA	
TCT Code :	214444	214449	214451	214453	214455	214456	METHOD
% MOISTURE:	38.10%	35.10%	26.80%	29.00%	50.10%	26.40%	BLANK
	0.619	0.649	0.732	0.71	0.499	0.736	

2,4-DINITROTOLUENE	1066 U	1017 U	902 U	930 U	1383 U	897 U	660 U
2,6-DINITROTOLUENE	1066 U	1017 U	902 U	930 U	1383 U	897 U	660 U
DIETHYLPHTHALATE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
4-CHLOROPHENYL-PHENYLETHER	210 U	200 U	178 U	183 U	281 U	177 U	130 U
FLOURENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
4-NITROANILINE	1066 U	1017 U	902 U	930 U	1383 U	897 U	660 U
4,6-DINITRO-2-METHYLPHENOL	1066 U	1017 U	902 U	930 U	1383 U	897 U	660 U
N-NITROSODIPHENYLAMINE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
4-BROMOPHENYL-PHENYLETHER	210 U	200 U	178 U	183 U	281 U	177 U	130 U
HEXACHLOROBENZENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
PENTACHLOROPHENOL	1066 U	1017 U	902 U	930 U	1383 U	897 U	660 U
PHENANTHRENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
ANTHRACENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
DI-N-BUTYLPHTHALATE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
FLUORANTHENE	210 U	200 U	273	183 U	281 U	177 U	130 U
PYRENE	210 U	231	328	183 U	281 U	177 U	130 U
BYRYLBENZYLPHTHALATE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
3,3'-DICHLOROBENZIDINE	436 U	416 U	369 U	380 U	1042	367 U	270 U
BENZ(A)ANTHRACENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
BIS(2-EHTYLHEXYL)PHTHALATE	743 B	416 B	1776 B	9437 B	281 U	2038 B	1900
CHRYSENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
DI-N-OCTYLPHTHALATE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
BENZO(B)FLUORANTHENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
BENZO(K)FLUORANTHENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
BENZO(A)PYRENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
INDENO(1,2,3-cd)PYRENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
DIBENZ(a,h)ANTHRACENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
BENZO(ghi)PERYLENE	210 U	200 U	178 U	183 U	281 U	177 U	130 U
SURROGATE RECOVERY:							
2-Fluorophenol	9%	10%	19%	33%	33%	68%	66%
Phenol-d5	22%	25%	40%	50%	47%	77%	79%
Nitrobenzene-d5	13%	9%	19%	33%	28%	58%	80%
2-Fluorobiphenyl	55%	40%	60%	59%	58%	81%	75%
2,4,6-Tribromophenyl	78%	99%	107%	51%	71%	68%	52%
Terphenyl-d14	44%	46%	53%	49%	40%	52%	63%

SEDIMENT DATA
Project: CHETCO RIVER
Sponsor: Portland COE

11/30/90

TOTAL ORGANIC CARBON

(Concentrations in percent dry wt.)

Sponsor Code :	CHR-P-1-EPA	CHR-P-2-EPA	CHR-P-3-EPA	CHR-P-4-EPA	CHR-P-5-EPA	CHR-P-8-EPA
TCT Code :	214444	214449	214451	214453	214455	214456
% MOISTURE:	38.10%	35.10%	26.80%	29.00%	50.10%	26.40%
TOC	1.12%	1.56%	1.09%	1.16%	2.28%	0.65%

SEDIMENT BUTYLTIN RESULTS

(Concentrations in ug/kg Dry Wt.)

Sponsor Code	TETRA-BUTYLTIN	TRI-BUTYLTIN	DI-BUTYLTIN	MONO-BUTYLTIN	% Surrogate Recovery PROPYLTIN
CHR-P-1	1.2	69	104.4	10	54%
CHR-P-5	1.1	47.2	33.4	11	64%
METHOD BLANK	0.7 U	0.8	2.7	0.6 U	48%

SEDIMENT QUALITY CONTROL DATA

TABLE 4 (continued)

METALS QUALITY CONTROL RESULTS

SAMPLE IDENTIFICATION: 214451 Matrix Spike

Compound	Amount in Sample (mg/kg)	Amount Spiked (mg/kg)	Amount Recovered (mg/kg)	Percent Recovery
Silver	ND	49.5	6.63	13%
Arsenic	6.2	49.3	46	81%
Cadmium	0.33	49.5	53.8	110%
Chromium	50	49.3	95	91%
Copper	26	49.3	69	87%
Nickel	65	49.3	106	83%
Lead	5.0	49.5	27.4	45%
Antimony	ND	49.3	4.9	10%
Mercury	0.10	0.20	0.21	71%
Zinc	75	49.3	120	91%

TABLE 2 (continued)

PESTICIDE QUALITY CONTROL RESULTS

SAMPLE IDENTIFICATION: 214456 Matrix Spike

Compound	Amount Spiked (ug/mL)	Amount Spiked (ug/g)	Amount Recovered (ug/mL)	Amount Recovered (ug/g)	Percent Recovery
Aldrin	0.50	0.030	0.66	0.039	130%
4,4' DDT	0.50	0.030	0.53	0.031	110%
Dieldrin	0.50	0.030	0.46	0.027	92%
Endrin	0.50	0.030	0.72	0.042	140%
Heptachlor	0.50	0.030	0.54	0.032	110%
Lindane (G-BHC)	0.50	0.030	0.54	0.032	110%
Surrogate: DBC	--	--	--	--	110%

SAMPLE IDENTIFICATION: 214456 Matrix Spike Duplicate

Compound	Amount Spiked (ug/mL)	Amount Spiked (ug/g)	Amount Recovered (ug/mL)	Amount Recovered (ug/g)	Percent Recovery
Aldrin	0.50	0.033	0.74	0.048	150%
4,4' DDT	0.50	0.033	0.55	0.036	110%
Dieldrin	0.50	0.033	0.33	0.022	67%
Endrin	0.50	0.033	0.65	0.042	130%
Heptachlor	0.50	0.033	0.52	0.034	110%
Lindane (G-BHC)	0.50	0.033	0.51	0.033	100%
Surrogate: DBC	--	--	--	--	120%

Date Extracted: October 19, 1990
Date Analyzed: October 21, 1990 through October 25, 1990

Laboratory No. 4410 90-7364

TABLE 2 (continued)

PCB QUALITY CONTROL RESULTS

SAMPLE IDENTIFICATION: 214453 Matrix Spike

Compound	Amount Spiked (ug/mL)	Amount Spiked (ug/g)	Amount Recovered (ug/mL)	Amount Recovered (ug/g)	Percent Recovery
PCB 1254	5.0	0.24	5.3	0.26	110%
Surrogate:					
DBC	--	--	--	--	130%

SAMPLE IDENTIFICATION: 214453 Matrix Spike Duplicate

Compound	Amount Spiked (ug/mL)	Amount Spiked (ug/g)	Amount Recovered (ug/mL)	Amount Recovered (ug/g)	Percent Recovery
PCB 1254	5.0	0.24	6.5	0.31	130%
Surrogate:					
DBC	--	--	--	--	80%

Date Extracted: October 23, 1990
Date Analyzed: October 25, 1990

SOIL SEMIVOLATILE MATRIX SPIKE/MATRIX SPIKE DUPLICATE RECOVERY

Lab Name: Twin City Testing Contract: Battelle.4

Lab Code: _____ Case No.: _____ SAS No.: _____ SDG No.: _____

Matrix Spike - EPA Sample No.: CHR-P-2-EPA Level: (low/med) _____

COMPOUND	SPIKE ADDED (ug/Kg)	SAMPLE CONCENTRATION (ug/Kg)	MS CONCENTRATION (ug/Kg)	MS % REC #	QC LIMIT REC.
Phenol	6600	0	1100	17 *	26- 9
2-Chlorophenol	6600	0	460	7 *	25-10
1,4-Dichlorobenzene	3300	0	0	0 *	28-10
N-Nitroso-di-n-prop.(1)	3300	0	490	15 *	41-12
1,2,4-Trichlorobenzene	3300	0	240	7 *	38-10
4-Chloro-3-methylphenol	6600	0	5200	79	26-10
Acenaphthene	3300	0	2300	70	31-13
4-Nitrophenol	6600	0	4700	71	11-11
2,4-Dinitrotoluene	3300	0	0	0 *	28- 8
Pentachlorophenol	6600	0	8200	124 *	17-10
Pyrene	3300	150	2200	62	35-14

COMPOUND	SPIKE ADDED (ug/Kg)	MSD CONCENTRATION (ug/Kg)	MSD % REC #	% RPD #	QC LIM RPD	QC LIM REC.
Phenol					35	26- 9
2-Chlorophenol					50	25-10
1,4-Dichlorobenzene					27	28-10
N-Nitroso-di-n-prop.(1)					38	41-12
1,2,4-Trichlorobenzene					23	38-10
4-Chloro-3-methylphenol					33	26-10
Acenaphthene					19	31-13
4-Nitrophenol					50	11-11
2,4-Dinitrotoluene					47	28- 8
Pentachlorophenol					47	17-
Pyrene					36	35-

(1) N-Nitroso-di-n-propylamine

Column to be used to flag recovery and RPD values with an asterisk
* Values outside of QC limits

RPD: _____ out of _____ outside limits
Spike Recovery: 7 out of 11 outside limits

COMMENTS: _____

TABLE 3 (continued)

TOTAL ORGANIC CARBON QUALITY CONTROL RESULTS

Sample Identification	Amount in Sample (ug/g)	Amount Spiked (ug/g)	Amount Recovered (ug/g)	Percent Recovery
214953 Matrix Spike	8240	4040	11800	110%

Laboratory No. 4410 90-7364

APPENDIX C

MERCURY TROUBLESHOOTING DATA

MERCURY ANALYSIS TROUBLESHOOTING DATA

Sample Identification	Total Mercury (mg/kg)	Matrix Spike Percent Recovery
214444 CHR-P-1	0.45	---
214444 Matrix Spike	See page 2, appendix B	See page 2, appendix B
214449 CHR-P-2	0.046	---
214449 Matrix Spike	0.13	60%
214451 CHR-P-3	0.10	---
214451 Matrix Spike	0.21	71%
214453 CHR-P-4	0.06	---
214453 Matrix Spike	0.24	130%
214455 CHR-P-5	0.06	---
214456 CHR-P-6	0.039	---

mg/kg is equal to parts-per-million (ppm).

Laboratory No. 4410 90-7364

MERCURY ANALYSIS TROUBLESHOOTING DATA

AVERAGE OF ANALYSIS RESULTS

CHR-P-1-EPA

Total Mercury Analysis Set	214444 (mg/kg)	214444 Matrix Spike (mg/kg)	214444 Matrix Spike Percent Recovery
Run 1	0.23	0.24	160%
Run 2	0.55	0.27	-300%
Run 3	0.48	*	*
Run 4	0.53	0.37	-125%

* Analysis result is out of instrument calibration range